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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/821,664	04/09/2004	Martin Fuchs	C0989.70023US01	8791

23628 7590 10/18/2007
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EXAMINER	
SHAW, AMANDA MARIE	
ART UNIT	**PAPER NUMBER**
1634	
MAIL DATE	**DELIVERY MODE**
10/18/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/821,664	FUCHS ET AL.	
	Examiner	Art Unit	
	Amanda M. Shaw	1634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,7-10,23,30 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,7-10,23,30 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is in response to the amendment filed July 25, 2007. This action is made non-final.

Claims 1-4, 7-10, 23, 30, and 31 are currently pending. Claims 1, 7, 23, 30, and 31 have been amended. Claims 1-4, 7-10, 23, 30, and 31 have been examined herein.

Withdrawn Rejections

2. The rejection made under 35 USC 112 2nd paragraph in section 3 of the Office Action of January 25, 2007 is withdrawn in view of amendments made to the claims.

The rejection made under 35 USC 102 in section 4 of the Office Action of January 25, 2007 is withdrawn in view of amendments made to the claims.

The rejections made under 35 USC 103 in sections 5-6 of the Office Action of January 25, 2007 are withdrawn in view of amendments made to the claims.

Claim Objections

The following is a new objection necessitated by amendment:

3. Claim 8 is objected to because claim 8 depends on the apparatus of claim 6, however claim 6 has been cancelled. For examination purposes claim 8 will be examined as if it depends from claim 7.

Claim Rejections - 35 USC § 112 1st paragraph

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a new rejection necessitated by amendment:

Claim 30 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This is a new matter rejection.

In the instant case the specification does not appear to provide support for the amendments made to claim 30. Specifically the specification does not appear to provide support for the phrases "a plurality of positions". The Applicants point to Figures 22 of the present application which shows one possible embodiment that corresponds to claim 30, as amended, and that may include transitions like those shown in Fig 21. Further it is noted that the specification (page 5) states "In another aspect, an apparatus is disclosed for maintaining a polymer in an elongated configuration. The apparatus comprises a micro channel constructed and arranged to contain a polymer carrier fluid. The microchannel has opposed sidewalls defining a first micro channel width, a second micro channel width, smaller than the first width, and a transition between the first and second micro channel widths. The transition is adapted to contact and inhibit relaxation of an elongated polymer contained within the first micro channel width". Thus while the specification appear to provide support for a "plurality of transitions", the specification does not provide support for a "plurality of positions".

Claim Rejections - 35 USC § 112 2nd paragraph

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

The following is a new rejection necessitated by amendment:

Claims 1-4, 7-10, 23 and 30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-4 and 7-10 are indefinite over the recitation of the phrases "a first section of the microchannel disposed..." and "a second section of the microchannel disposed...". These phrases are considered indefinite because it is unclear if they refer to additional components of the apparatus or if they are intended to further define the microchannel.

Claim 23 is indefinite over the recitation of the phrase "a first set of substantially opposed funnel shaped walls...". This phrase is considered indefinite because it is unclear if it refers to an additional component of the apparatus or if it is intended to further define the microchannel.

Claim 30 is indefinite over the recitation of the phrase "a plurality of positions defining a second microchannel". This phrase is considered indefinite because it is unclear what a "plurality of positions" refers to and how it defines the second microchannel. This phrase is not defined in the specification and there is no art

recognized definition for this phrase. Therefore it is unclear what is required by the claims.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a new rejection:

7. Claim 30 is rejected under 35 U.S.C. 102 (a) and (e) as being anticipated by Chan (US Patent 6762059 Filed 2/2001 Pub 6/2002).

Prior to setting forth this rejection a "plurality of positions" is being interpreted as a "plurality of transitions".

Regarding Claim 30 Chan teaches a funnel shaped microchannel. The channel begins at a first width at a first end and continuously decreases to a second width at a second end creating an elongational force in the funnel portion of the channel (Column 30, lines 46-56). Chan teaches that these microchannels offer especially good protection against natural relaxation of the polymer since as the molecules move down

the channel they experience increasing elongational forces to counter their tendency to recoil (Column 31, lines 8-12). Chan also teaches embodiments where there are a plurality of transitions (see figures 4a, and 4b). Thus Chan teaches an apparatus comprising a microchannel constructed and arranged to contain a polymer in a carrier fluid, the microchannel having opposed sidewalls defining a first microchannel width, and a plurality of transitions defining a second microchannel width, that is smaller than the first width wherein transitions between each of the opposed walls defining the first microchannel width and each of the plurality of positions that define the second microchannel width contact and inhibit relaxation of a stationary elongated polymer.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The following is a new rejection necessitated by amendment:

9. Claims 1-10, are rejected under 35 U.S.C. 103(a) as being unpatentable over Blankenstein (US Patent 6432630 Filed 1999) in view of Chan (US Patent 6762059 Filed 2001).

Regarding Claim 1 Blankenstein teaches an apparatus comprising a polymer carrier fluid including at least one polymer (Column 4, lines 11-14). Blankenstein teaches that the apparatus comprises a flow channel comprising a first inlet means positioned at one end of the flow channel for entering fluid into the flow channel and a first outlet means positioned at the other end of the flow channel for discharging the fluid from the flow channel (Column 2, lines 55-64). Blankenstein teaches that preferably the flow through the flow channel is a laminar flow (Column 4, lines 15-22). Thus the apparatus of Blankenstein comprises a microchannel having first and second ends, the microchannel being constructed and arranged to transport the polymer carrier fluid such that, when present the polymer flows from the first end toward the second end in a laminar flow stream. Blankenstein teaches that the apparatus has a second and third inlet means for entering a first and second guiding buffer (Column 5, lines 1-30). In the instant case the second and third inlet means are being interpreted as the opposed flow control channels. Thus the apparatus of Blankenstein comprises opposed flow control channels in fluid communication with the microchannel, the flow channels being

positioned between the first section and the second end of the microchannel. Blankenstein teaches that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Thus the apparatus of Blankenstein also comprises a flow controller to control the flow of fluid through the opposed flow control channels to maintain the flow stream containing the polymer in a laminar state isolated from the substantially opposed sidewalls of the microchannel at points downstream from the opposed flow control channels. Blankenstein further teaches that the outlet channel forms a chamber where the sorted particles are collected for detection (column 15, lines 53-56). Thus the apparatus of Blankenstein comprises a detection zone. Additionally please see Fig 1.

Blankenstein does not teach an apparatus wherein the first section of the microchannel has a first set of substantially opposed funnel shaped sidewalls constructed and arranged to create a first velocity gradient in the flow stream passing there through and a second section of the microchannel has a second set of substantially opposed funnel shaped sidewalls constructed and arranged to created a second velocity gradient in the flow stream passing there through.

However Chan teaches an apparatus with tapered microchannels that begins at a first width at a first end and continuously decreases to a second width at a second end, creating an elongational force in the funnel portion of the channel (Column 30, lines 46-56). Chan further discloses microchannels having first and second sets of substantially opposed funnel shaped sidewalls (See Fig 4 a-c). Thus Chan teaches an

apparatus wherein the first section of the microchannel has a first set of substantially opposed funnel shaped sidewalls constructed and arranged to create a first velocity gradient in the flow stream passing there through and a second section of the microchannel has a second set of substantially opposed funnel shaped sidewalls constructed and arranged to created a second velocity gradient in the flow stream passing there through.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of Blankenstein by using a microchannel comprising first and second sets of substantially opposed funnel shaped sidewalls as suggested by Chan particularly in instances where it is desirable to elongate the polymer as it moves through the channel. Chan teaches that the funnel shaped channels apply elongation forces in a regular and continuous manner so that as the polymer flows down the channel it experiences increasing elongation forces which counteract the tendency for the polymer to recoil thus keeping it elongated (Column 31, lines 8-12).

Regarding Claim 2 Blankenstein teaches that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Therefore one can control the flow of the polymer from the first end of the microchannel into the detection zone. Thus Blankenstein teaches an apparatus wherein the flow controller is adapted to move the polymer into the detection zone.

Regarding Claim 3 Blankenstein teaches that it is possible to control the flow velocities of the fluid containing particles at the particle inlet of the member and the flow velocities of guiding buffers at corresponding inlets (Column 4, lines 15-22). Therefore there is at least two controllers one for each of the guiding buffer inlets. Thus Blankenstein teaches an apparatus wherein the flow controller comprises at least two flow controllers, each of the at least two controllers for independently controlling the flow of fluid through each of the opposed flow control channels.

Regarding Claim 4 Blankenstein teaches that conventional syringe pumps to move the pistons at a predetermined speed have been utilized for generating a continuous flow of the guiding buffer through the inlet tube and a continuous flow of the sample through the inlet tube (Column 15, lines 10-14). In the instant case pressure must be applied to the syringe pump in order to move the pistons. Thus Blankenstein teaches an apparatus wherein the flow controller comprises a pressure source.

Regarding Claim 7 Blankenstein teaches an apparatus comprising an outlet channel which leads into a chamber where the sorted particles are detected (Column 15, lines 53-57). Thus Blankenstein teach an apparatus wherein there is an outlet channel separating the second velocity gradient and the detection zone. Blankenstein does not specifically say that the outlet channel is at least as long as the length of a polymer. However in the instant case a polymer encompasses nucleic acids which are only two base pairs long. Thus the outlet channel would be at least as long as two base pairs.

Regarding Claims 8 and 9 Blankenstein teaches an apparatus wherein the polymer is a biomolecule, such as DNA or RNA (column 4, lines 10-15).

Regarding Claim 10 Blankenstein teaches that the when the flow is laminar, the two fluids flow through the flow channel in parallel abutting each other along a small area extending along a longitudinal axis of the flow channel whereby the cross section and the path through the flow channel of the flow of the fluid containing particles may be controlled by the first guiding buffer flow (Column 5, lines 1-17). Thus Blankenstein teaches an apparatus adapted to create a fluidic boundary between the carrier fluid and the flow through the opposed flow control channels wherein the opposed flow controller is further adapted to control a shape of the fluidic boundary.

The following is a new rejection necessitated by amendment:

10. Claims 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blankenstein (US Patent 6432630 Filed 1999) in view of Perkins (Science 1997) and in further view of Chan (US Patent 6762059 Filed 2/2001 Pub 6/2002).

Regarding Claim 23 Blankenstein teaches an apparatus comprising a polymer carrier fluid including at least one polymer (Column 4, lines 11-14). Blankenstein teaches that the apparatus comprises a flow channel comprising a first inlet means positioned at one end of the flow channel for entering fluid into the flow channel and a first outlet means positioned at the other end of the flow channel for discharging the fluid from the flow channel (Column 2, lines 55-64). Blankenstein teaches that preferably the flow through the flow channel is a laminar flow (Column 4, lines 15-22). Thus

Blankenstein teaches an apparatus comprising a microchannel having first and second ends, the microchannel being constructed and arranged to transport the polymer carrier fluid such that, when present the polymer flows from the first end toward the second end in a laminar flow stream. Blankenstein teaches a second and third inlet means for entering a first and second guiding buffer (Column 5, lines 1-30). In the instant case the second and third inlet means are being interpreted as the opposed flow control channels. The Blankenstein teaches an apparatus with opposed flow control channels in fluid communication with the microchannel through the opposed sidewalls. Blankenstein teaches also that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Thus the apparatus also comprises a first end fluid controller for directing a fluid through the microchannel from the first end and an opposed flow controller for controlling the flow of the fluid through the opposed flow control channels.

Blankenstein does not teach an apparatus comprising a polymer elongation zone. Further Blankenstein does not teach an apparatus comprising a first set of substantially opposed funnel shaped walls positioned at the first end of and constructed and arranged to create a first velocity gradient in the flow stream of the carrier fluid passing by. Blankenstein also does not teach an apparatus comprising opposed polymer control channels in fluid communication with the microchannel through the opposing sidewalls, the polymer control channels defining the polymer elongation zone and being positioned between the opposed flow control channels and the second end of

the microchannel. Blankenstein additionally does not teach an opposed polymer channel controller and a second end flow controller.

Perkins teaches an apparatus comprising a polymer elongation zone. In the instant case a polymer elongation zone is being interpreted as the area adjacent to the stagnation zone where the streamlines separate. Specifically in Fig 2A inset one can see the area adjacent to the stagnation zone where the streamlines separate (see arrows). Further Perkins teaches an apparatus comprising opposed polymer control channels in fluid communication with the microchannel through the opposing sidewalls, the polymer control channels are adapted to provide a flow of fluid for defining the polymer elongation zone, and the polymer control channels are positioned between the first end and the second end of the microchannel. Specifically in Fig 2A inset the two channels that are flowing away from the stagnation zone are the opposed polymer control channels. They define the polymer elongation zone by creating a point of stagnation and they are positioned between the first end and second end of the microchannel.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of Blankenstein so that is has a polymer elongation zone and opposed polymer control channels as suggested by Perkins. An apparatus such as the one described by Perkins is beneficial to practioners in the art who are interested in studying the internal structure of a polymer. The stagnation point allows for prolonged observation of the polymer or manipulation of the polymer.

The combined references of Blumenstein and Perkins do not teach an apparatus comprising a first set of substantially opposed funnel shaped walls positioned at the first end of and constructed and arranged to create a first velocity gradient in the flow stream of the carrier fluid passing by.

However Chan teaches tapered microchannels that begins at a first width at a first end and continuously decreases to a second width at a second end, creating an elongational force in the funnel portion of the channel (Column 30, lines 46-56). Chan further discloses microchannels having first and second sets of substantially opposed funnel shaped sidewalls (See Fig 4 a-c). Thus Chan teaches an apparatus wherein the first section of the microchannel has a first set of substantially opposed funnel shaped sidewalls constructed and arranged to create a first velocity gradient in the flow stream passing there through and a second section of the microchannel has a second set of substantially opposed funnel shaped sidewalls constructed and arranged to created a second velocity gradient in the flow stream passing there through.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of Blankenstein by using a microchannel comprising first and second sets of substantially opposed funnel shaped sidewalls as suggested by Chan particularly in instances where it is desirable to elongate the polymer as it moves through the channel. Chan teaches that the funnel shaped channels apply elongation forces in a regular and continuous manner so that as the polymer flows down the channel it experiences increasing elongation forces, which

counteract the tendency for the polymer to recoil thus keeping it, elongated (Column 31, lines 8-12).

The combined references of Blankenstein, Perkins, and Chan do not specifically disclose an opposed polymer channel controller for controlling the flow of fluid through the opposed polymer control channels or a second end fluid controller for directing fluid through the microchannel from the second end toward the polymer elongation zone. However Blumenstein teaches that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to controllers for controlling the flow of fluid through each portion of the apparatus.

The following is a new rejection necessitated by amendment:

11. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blankenstein (US Patent 6432630 Filed 1999) in view of Perkins (Science 1997) and in further view of Chan (US Patent 6762059 Filed 2/2001 Pub 6/2002).

Regarding Claim 31 Blankenstein teaches an apparatus with a flow channel comprising a first inlet means positioned at one end of the flow channel for entering fluid into the flow channel and a first outlet means positioned at the other end of the flow channel for discharging the fluid from the flow channel (Column 2, lines 55-64). Blankenstein teaches that preferably the flow through the flow channel is a laminar flow (Column 4, lines 15-22). Thus Chan teaches an apparatus comprising a microchannel

having first and second ends and opposing sidewalls, the microchannel being constructed and arranged to transport a polymer in a carrier fluid such that when present, the polymer flows from the first end in a laminar flow stream. Blankenstein also teaches that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Thus Blankenstein teaches an apparatus comprising a first end fluid controller for directing a fluid through the microchannel from the first end.

Blankenstein does not teach an apparatus comprising a polymer elongation zone. Further Blankenstein does not teach an apparatus comprising opposed polymer control channels in fluid communication with the microchannel through the opposing sidewalls, the polymer control channels adapted to provide a flow of fluid for defining the polymer elongation zone, the polymer control channels positioned between the first end and the second end of the microchannel, wherein at least one of the polymer control channels includes a plurality of transitions to a narrower microchannel width, the transitions for contacting and inhibiting relaxation of an a stationary, elongated or aligned polymer contained in the narrower width, and further wherein at least one of the polymer control channels includes at least one serpentine bend to cause at least one portion of the polymer control channel to be located adjacent and parallel to another portion of the polymer control channel. Further Blankenstein does not teach an opposed polymer channel controller for controlling the flow of fluid through the opposed polymer control channels or a second end fluid controller.

Perkins teaches an apparatus comprising a polymer elongation zone. In the instant case a polymer elongation zone is being interpreted as the area adjacent to the stagnation zone where the streamlines separate. Specifically in Fig 2A inset one can see the area adjacent to the stagnation zone where the streamlines separate (see arrows). Further Perkins teaches an apparatus comprising opposed polymer control channels in fluid communication with the microchannel through the opposing sidewalls, the polymer control channels are adapted to provide a flow of fluid for defining the polymer elongation zone, and the polymer control channels are positioned between the first end and the second end of the microchannel. Specifically in Fig 2A inset the two channels that are flowing away from the stagnation zone are the opposed polymer control channels. They define the polymer elongation zone by creating a point of stagnation and they are positioned between the first end and second end of the microchannel.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of Blankenstein so that is has a polymer elongation zone and opposed polymer control channels as suggested by Perkins. An apparatus such as the one described by Perkins is beneficial to practioners in the art who are interested in studying the internal structure of a polymer. The stagnation point allows for prolonged observation of the polymer or manipulation of the polymer.

The combined references of Blumenstein and Perkins do not teach an apparatus wherein at least one of the polymer control channels includes a plurality of transitions to

a narrower microchannel width, the transitions for contacting and inhibiting relaxation of an a stationary, elongated or aligned polymer contained in the narrower width, and further wherein at least one of the polymer control channels includes at least one serpentine bend to cause at least one portion of the polymer control channel to be located adjacent and parallel to another portion of the polymer control channel.

However Chan teaches an apparatus comprising a microchannel comprising a plurality of transitions to a narrower microchannel width (Fig 4a and 4b). Chan also teaches that the transitions are for contacting and inhibiting relaxation of a stationary, elongated, or aligned polymer contained in the narrower width. Chan teaches that as the molecules move down a channel where the width of the channel is decreasing, the molecules experience increasing elongational forces to counter their tendency to recoil (Column 31, lines 5-34). Further Chan teaches a microchannel comprising at least one serpentine bend to cause at least one portion of the polymer control channel to be located adjacent and parallel to another portion of the polymer control channel. Specifically Chan teaches that that a microchannel comprising a bend helps achieve stretching because as the fluid encounters changes in its path the fluid on the outside of the curve or corner will take longer to go around the turn than the fluid on the inside of the curve or corner. This so called "racetrack effect" can help stretch out polymers (column 32, lines 38-59).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Blankenstein and Perkins by using an opposed flow channel which comprises a plurality of transitions to a smaller

width and at least one bend as suggested by Chan for the benefit of being able to stretch a polymer. Specifically Chan teaches that as the molecules move down a channel where the width of the channel is decreasing, the molecules experience increasing elongational forces to counter their tendency to recoil (Column 31, lines 5-34). Chan also teaches that bends helps achieve stretching because as the fluid encounters changes in its path the fluid on the outside of the curve or corner will take longer t go around the turn than the fluid on the inside of the cure or corner. This so called "racetrack effect" can help stretch out polymers (Column 32, lines 38-59). Thus it would have been obvious to practioners who are interested in studying the internal structure of polymers to use microchannels having a plurality of transitions to smaller width as well as bends. Typically polymers are in a coiled conformation however when a polymer flows through a channel and encounters decreasing widths or bends the polymer becomes elongated. Thus the decreasing widths and bends aid in keeping the polymer elongated so that it can further be studied.

The combined references of Blankenstein, Perkins, and Chan do not specifically disclose an opposed polymer channel controller for controlling the flow of fluid through the opposed polymer control channels or a second end fluid controller for directing fluid through the microchannel from the second end toward the polymer elongation zone. However Blumenstein teaches that the apparatus comprises a flow rate adjustment means and that by adjusting the flow velocities the flow within the flow channel of fluid may be controlled (Column 4, lines 56-58, Column 5, lines 31-40). Therefore it would

have been obvious to one of ordinary skill in the art at the time the invention was made to add controllers for controlling the flow of fluid through each portion of the apparatus.

Conclusion

12. No Claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amanda M. Shaw whose telephone number is (571) 272-8668. The examiner can normally be reached on Mon-Fri 7:30 TO 4:30. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ram Shukla can be reached at 571-272-0735. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Amanda M. Shaw
Examiner
Art Unit 1634

RAM R. SHUKLA, PH.D.
SUPERVISORY PATENT EXAMINER